REMARKS

This application contains claims 1 – 11, 13, 14, 16 –18, 31 and 32. Claim1 has been amended to resolve an antecedency matter, and to otherwise more particularly point out and distinctly claim Applicants' invention. Claims 12 and 15 have been cancelled in favor of new claims 31 and 32 which depend from claim 1, and show the generic relationship between claim 1 and all of the product claims. Claims 13, 14, 16-18, 31 and 32 have not been considered. Claims 19 – 30 have been withdrawn from consideration, without prejudice, incident to a Requirement for Restriction. The term "fibrillose" has been retained in claim 6, and is defined in The American Heritage Dictionary (2nd College Edition, © 1985) as "Having or consisting of fibrils" .

Claims 5,9 and 10 are said to be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims from which they depend. For the reasons set forth hereafter, there is no need to rewrite claims 5, 9 and 10 at this time.

Claims 1-4, 6 and 11 stand variously rejected under 35 USC 103(a) over Cisar et al. 6,562,507 in view of either Braun et al. 2002/0039675 A1, or Bisaria et al. 6,379,795 B1, on the principal grounds that it would be obvious to substitute the "composite" current collector substrate of either Braun or Bisaria for the metal current collector substrate of Cisar. Applicants' respectfully traverse the several rejections on the principal grounds that both the Cisar-Braun and the Cisar-Bisaria combinations are improper because (1) Cisar teaches away from the proffered combinations, and (2) there is no motivation to make the proffered combinations. Reconsideration of claims 1-11, and consideration of claims 13, 14, 16-18, 31 and 32 in light of the following remarks is respectfully requested.

THE INVENTION

The present invention relates to PEM fuel cells, and seeks to reduce the contact resistance between a porous gas-diffusion media and a contiguous composite current collector comprising electrically conductive particles in a polymeric matrix. To this end, Applicants provide the composite with a hyperconductive (i.e. a higher conductivity than the composite) surface layer that engages the gas-diffusion media and serves to shunt electrical current passing through the media to the conductive particles of the composite that reside at the interface between the hyperconductive surface layer and the composite. In one embodiment, the entire current collector is made from the composite material. In another embodiment, the current collector comprises one or more layers of metal coated with the composite material which, in turn, is covered with the hyperconductive layer. According to a preferred embodiment, the hyperconductive surface layer comprises a plurality of oxidation-resistant and acid-resistant electrically conductive particles embedded in a surface of the composite so as to provide a higher concentration of conductive particles at the surface than throughout the remainder of the composite.

THE CITED ART

Cisar et al. 6,562,507 was not faced with Applicants' problem, and proposed no solution to it. Rather, Cisar relates to a bipolar electrode subassembly for a PEM-type electrochemical cell (e.g. fuel cell) that combines the functions of gas distribution, gas diffusion, current-collection and gas barrier into a unitized, metallurgically-bonded, corrosion-resistant, porous metal structure that replaces performance-limiting composites (i.e. graphite particles in resin matrix) prevalent in such cells at the time. Cisar seeks to eliminate composites from electrochemical cells in favor

of low-cost, low-volume, light-weight, electrically/thermally conductive, corrosion-resistant, porous metal electrode subassemblies that do not require significant compression when assembled into stacks. More specifically, Cisar's electrode subassembly comprises a porous metal gas diffusion layer metallurgically bonded to a porous metal flow field which, in turn, may be metallurgically bonded to a metal gas-barrier/current-collector layer. The gas-diffusion layer may also include a gas-diffusion matrix comprising carbon fiber/powder in a hydrophobic binder (e.g. PTFE). The barrier layer/current collector may be coated with gold to protect it from corrosion.

BRAUN et al 2002/0039675 A1 and Bisaria 6,379,795 are similar in that they both disclose fuel cells having current collectors comprising conductive particles (e.g. carbon/graphite) in a polymeric matrix -- i.e. the same sort of composites that Cisar et al. seeks to eliminate. Braun's composite is said to be conductive and corrosion-resistant. Bisaria's composite is said to be conductive, strong and stiff.

THE REJECTIONS

The Examiner has rejected claims 1-4,6, and 11 as being obvious over Cisar in view of Braun . With respect to claims 1 and 4, the Examiner focuses on Cisar's teaching that: "*A light coating of noble metal on the porous titanium sheets insures a long service life and stable operation even in a very corrosive environment...*", and concludes therefrom that it would be obvious to substitute the conductive polymers of Braun for Cisar's titanium current collector because Braun teachs that polymer composites exhibit good corrosion resistance. The Examiner's position is incongruous, untenable and provides no motivation for the proffered combination of references. In this regard, Cisars' gold coating is needed to protect the titanium from corrosion because the titanium is not corrosion resistant in the fuel cell environment. Brauns' composites, on the other hand, are corrosion-resistant and therefore do not need a protective gold coating. Since Braun's composites are already corrosion resistant, there is no need to coat them with gold, and accordingly no motivation to combine the references as the Examiner has done.

Similarly, the Examiner has combined Cisar with Bisaria, and contends that it would be obvious to substitute Bisaria's composite current collector for Cisars' metal current collector because Bisaria's components are conductive and strong. Suffice to say, Cisar's all-metal current collector is stronger, and more conductive than Bisaria's composite current collector. Hence, there would be no motivation to substitute the weaker and less conductive composite of Basaria for the superior materials of Cisar.

Finally and quite significantly, Cisar "teaches away" from the proffered combination of references. In this regard, Cisar deplores the use of composite current collectors in electrochemical cells, and for no less than four introductory columns of text in the specification, decries their use in fuel cells. Cisar et al. seeks to eliminate composite current collectors ~~from fuel cells.~~ and to replace them with all-metal current collectors. There is clearly nothing in the references themselves to suggest the proffered Cisar-Braun or Cisar-Bisaria combinations, and the Examiner's justifications for such combinations are *non-sequiturs* for the reasons set forth above. Indeed, the proffered combinations are seen to be naught but the product of hindsight illuminated by Applicants' disclosure, and not the result of teachings found in the references themselves. Accordingly, the Cisar-Braun and Cisar –Bisaria combinations are improper. Withdrawal of the rejection based on these combinations is respectfully requested.

The Examiner inappropriately cites In Re Robertson. Robertson is not applicable to 35USC103 rejections that rely on a combination of references. Rather, Robertson is only applicable to 35USC102 rejections that rely on the inherent teaching of a reference to anticipate the rejected claims.

Claims 2-4, 8, and 11 depend on claim 1 for their patentability.

Claim 6 is dependant on claim 3, and specifies that the particles are fibrillose and are <u>oriented in the direction of current flow</u>. No such teaching is found in Cisar, Braun or Bisaria. Accordingly, withdrawal of the rejection is respectfully requested.

Claim 7 calls for the fibers to be continuous and extend through the thickness of the composite (i.e. in the direction of current flow perpendicular to the plane of the electrode). Nothing in Basari suggests such an orientation of the fibers. Long fibers could just as well lie in the plane of the electrode, as would occur, for example, if the composite plates were extruded from a melt of the composite material.

Claim 31 calls for the hyperconductive layer to comprise a plurality of oxidation-resistant and acid-resistant, electrically-conductive particles adhering to the surface of the composite. No such teaching is found in the references of record, and accordingly withdrawal of the rejection is respectfully requested. Claim 13 is dependant on claim 31 and patentable therewith. Claim 14 is dependant on claim 31, and specifies that the particles are at least partially embedded in the surface of the composite.

Claim 32, is dependant on claim 1 and is patentable therewith. Claims 16 and 17 are dependant on claim 32 and call for vapor-deposited and electrolessly deposited surface films. No such teachings are found in the references of record.

Claim 18 is dependant on claim 32 and calls for the surface film to comprise a plurality of corrosion-proof conductive particles dispersed throughout an oxidation-resistant and acid resistant polymer matrix. No such teaching is found in the references of record.

In view of the foregoing, the Examiner is respectfully requested to reconsider this application, and to pass it to issue at his earliest convenience.

Respectfully submitted

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